

AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning at page 6, line 12, to page 7, line 23 with the following rewritten paragraphs:

-- An example of the first class of antioxidants suitable for use in the present invention is 3,3',3'',5,5',5''-hexa-tert-Butyl-alpha,alpha',alpha''-(mesitylene-2,4,6-triyl)tri-p-cresol (CAS 1709-70-2) commercially available as ~~Irganox~~ IRGANOX™ 1330 (Ciba Specialty Chemicals) or 1,3,5-trimethyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl) benzene commercially available as ~~Ethanox~~ ETHANOX™ 330 (Albemarle Corporation).

However, it was discovered that this first class of antioxidants is not as effective against chlorine and oxygen exposure as desired. For efficacy against chlorine exposure and oxygen in the air, a second class of antioxidants is preferred.

The second class of antioxidants correspond to the same general formula as the first class wherein R₁ and R₅ can be -CH₃, -CH(CH₃)₂, or -C(CH₃)₃, and R₂, R₃, and R₄ can independently be any hydrocarbon or substituted hydrocarbon group provided that R₂, R₃ and R₄ are chosen such that the antioxidant does not contain the moiety Ph-CHR₆-Ph, where Ph represents a phenyl ring and R₆ can be H or a phenyl ring. Examples of the second class of antioxidants include Pentaerythritol Tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate) (CAS 6683-19-8) available as ~~Irganox~~ IRGANOX™ 1010 (Ciba Specialty Chemicals); Octadecyl-3-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionate (CAS 002082-79-3) available as ~~Irganox~~ IRGANOX™ 1076; 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione (CAS 2767-62-6) available as ~~Irganox~~ IRGANOX™ 3114; 1,3,5-TRIS(4-tert-butyl-3-hydroxy-2,6-dimethyl benzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione (CAS 040601-76) available as Cyanox 1790 (CyTech Industries); Ethylenebis(oxyethylene)bis-(3-(5-tert-butyl-4-hydroxy-m-tolyl)-propionate) (CAS 36443-68-2) available as ~~Irganox~~ IRGANOX™ 245;

1,6-Hexamethylene bis (3,5-di(tert)-butyl-4-hydroxyhydrocinnamate (CAS 35074-77-2) available as ~~Irganox~~ IRGANOX™ 259; Thiodiethylene bis[3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate] (CAS 41484-35-9) available as ~~Irganox~~ IRGANOX™ 1035; and mixtures thereof.

For use in pipes intended for use with chlorinated water, therefore, it has been discovered that an additive package comprising at least one antioxidant from the first class together with at least one antioxidant from the second class leads to synergistic results. It is preferred that the resin used to make the pipes contain from at least about 300 more preferably 400 and most preferably about 500 ppm up to about 5000ppm, more preferably about 4000 ppm, most preferably about 3000 ppm of each class of additive.

Other additives may also be added to the resin or the antioxidant package, including still other antioxidants which may be more effective at preventing oxidation at higher temperatures which the resin may be exposed to during extrusion. Such antioxidants include phosphites and phosphonites such as Tris(2,4-ditert-butylphenyl)phosphate (CAS 31570-04-4) available as ~~Irgafos~~ IRGAFOS™ 168. Metal deactivators such as 2',3-bis[[3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyl]]propionohydrazide. (CAS 32687-78-8) available as ~~Irganox~~ IRGANOX™ MD 1024 and 2,2'-oxalyldiamidobis[ethyl 3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate] (available as ~~Naugard~~ NAUGARD™ XL1); processing aids; UV stabilizers; other antioxidants; pigments or colorants can also be advantageously used with the compositions of the present invention.

When used to make pipes for use with chlorinated water, the resin of the present invention contains hindered phenols such as 3,3',3'',5,5',5''-hexa-tert-Butyl-alpha,alpha',alpha''-(mesitylene-2,4,6-triyl)tri-p-cresol (CAS 1709-70-2) commercially available as ~~Irganox~~ IRGANOX™ 1330, hindered phenols such as Pentaerythritol Tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate) (CAS

6683-19-8) commercially available as ~~Irganox~~ IRGANOX™ 1010 and/or Octadecyl-3-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionate (CAS 002082-79-3) commercially available as ~~Irganox~~ IRGANOX™ 1076, phosphites such as Tris(2,4-ditert-butylphenyl)phosphate (CAS 31570-04-4) commercially available as ~~Irgafos~~ IRGAFOS™ 168 and metal deactivators such as 2',3-bis[[3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyl]]propionohydrazide. (CAS 32687-78-8) commercially available as ~~Irganox~~ IRGANOX™ MD 1024 and/or 2,2'-oxalyldiamidobis[ethyl 3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate] commercially available as ~~Naugard~~ NAUGARD™ XL1. --

Please replace the paragraph beginning at page 8, line 29, to page 9, line 23 with the following rewritten paragraphs:

-- Examples

Various resin formulations were prepared by first blending a masterbatch containing additives to a base resin in order to achieve the additive levels (in ppm) specified in Table 1. For examples 1-8 the base resin was an ethylene/octene resin with a density of 0.941 g/cc and a melt index (I₂) of 0.85 g/10 min (determined according to ASTM D-1238, condition E, 190°C/2.16 kg).

For Example 9 the base resin was polyethylene resin having a density of 0.933 and a melt index (I₂) of 0.7. For Example 10, the base resin was a polyethylene resin having a density of 0.9345 g/cc and a melt index (I₂) of 0.6. In Table 1, AO 1 is ~~Irganox~~ IRGANOX™ 1330 (3,3',3'',5,5',5''-hexa-tert-Butyl-alpha,alpha',alpha''-(mesitylene-2,4,6-triyl)tri-p-cresol (CAS 1709-70-2)), a hindered phenol antioxidant; MD is a metal deactivator, (~~Naugard~~ NAUGARD™ XL1 (2,2'-oxalyldiamidobis[ethyl 3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate]) for Examples 1,3,4,6,8, and 9 and ~~Irganox~~ IRGANOX™ MD1024 (2',3-bis[[3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyl]]propionohydrazide. (CAS 32687-78-8)) for Examples 2 and 5); AO2 is Chimassorb™ 944 a hindered amine antioxidant; AO3 is ~~Irgafos~~ IRGAFOS™ 168 (Tris(2,4-ditert-

butylphenyl)phosphate (CAS 31570-04-4), a phosphite antioxidant; A04 is ~~Irganox~~ IRGANOX™1010 (Pentaerythritol Tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate) (CAS 6683-19-8)), a hindered phenol antioxidant ; and A05 is ~~Irganox~~ IRGANOX™1076 (Octadecyl-3-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionate (CAS 002082-79-3)), a hindered phenol.

The formulated resins were then extruded at commercial pipe extrusion lines to make pipes having a 17 mm (except for Example 9 which was 16 mm and Example 10 which was 16mm) outer diameter and a 2 mm thickness. These pipes were evaluated for chlorine resistance according to Jana Laboratories Procedure APTF-2, and the time until failure (F time) is reported in the last column of Table 1. The testing conditions were as follows: pH 6.8 (± 0.1); Chlorine 4.1 mg/L (± 0.1); Nominal ORP 830mV; fluid temperature 110°C (± 1); air temperature 110°C (± 1); pressure 70 psig (± 1); flow rate 0.1 Us gallons/min (± 10 percent).

At a later point in time a second set of tests were run and reported as Samples 11-19. These samples were all made with the base resin was an ethylene/octene resin with a density of 0.941 g/cc and a melt index (I_2) of 0.85 g/10 min (determined according to ASTM D-1238, condition E, 190°C/2.16 kg). The MD was ~~Nauguard~~ NAUGUARD™ XL1 (2,2'-oxalyldiamidobis[ethyl 3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate]) for Samples 11-13 and 15-19 and ~~Irganox~~ IRGANOX™ MD1024 (2',3-bis[[3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyl]]propionohydrazide. (CAS 32687-78-8)) for Sample 14. The pipes prepared were all 16mm in diameter. The testing method was identical to that previously described.--